

REMARKS

This is intended as a full and complete response to the Office Action dated January 5, 2010, having a shortened statutory period for response set to expire on April 5, 2010. Claims 1, 10, 22-27 and 29 have been amended to more clearly recite various aspects of the invention. Support for the amendments may be found throughout the specification, including paragraphs [0078]-[0092]. Applicants believe no new matter has been introduced by the amendments presented herein. The amendments have been made in a good faith effort to advance prosecution on the merits. Please reconsider the claims pending in the application for reasons discussed below.

Applicants would like to thank the Examiner for considering the arguments filed on October 26, 2009 and for withdrawing the rejection with respect to claims 1, 10, 12-16 and 21-28.

Claims 1 and 21-29 stand rejected under 35 U.S.C. §101 for reciting non-statutory subject matter. Claims 1 and 29 have been amended to now recite “using a processor” to tie the methods to a particular machine. Support for the amendments may be found throughout the specification, including paragraph [0092] and Figure 11. Accordingly, withdrawal of the rejection is respectfully requested.

Claims 1, 10, 12, 13 and 29 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,532,190 (“Bachrach”) in view of U.S. Patent No. 6,366,531 (“Varsamis”) and U.S. Patent No. 6,611,764 (“Zhang”). Claims 1, 10 and 29 have been amended to now include applying a normal moveout correction to the **gain recovered** seismic data, muting the **normal moveout corrected** seismic data, stacking the **muted** seismic data and applying a time migration to the **stacked** acceleration wavefield traces. Support for the amendments may be found throughout the specification, including paragraphs [0078]-[0081]. Applicants respectfully submit that neither Bachrach nor Varsamis nor Zhang teaches the newly added limitations.

Bachrach is generally directed towards a seismic sensor array that is part of a seismic measurement recording system which includes a data collection box and a computer. (See Bachrach, Abstract). The relevant portion of Bachrach is provided below for the Examiner’s convenience.

The software used to generate the three-dimensional images is laid out in a flow chart of FIG. 12. The four basic steps to the processing sequence re: 1) bandpass filtering of the data with a window of 300 Hz to 3000 Hz; **2) muting the first arriving signals; 3) Normal Movement (NMO) correction of the data; 4) binning of the data and stacking same.** A more detailed description of the process is as follows: the data is received from data collection box 27; band pass filtering of the data and muting of the first arriving signals is done on the data collection box; and the data that is received from data collection box 27 by computer 29 then displays the geometry of the acquisition data to verify that the data was indeed captured.

As shown above, Bachrach does not teach applying a normal moveout correction to the **gain recovered seismic data** and muting the normal moveout corrected seismic data, as recited in claims 1, 10 and 29. In contrast, Bachrach teaches muting the first arriving signals **before** performing a normal moveout correction of the data, which is not the same as muting the seismic data **after** applying an NMO correction to data. In this manner, Bachrach teaches away from the claimed invention.

Further, Bachrach does not teach muting the normal moveout corrected seismic data, as recited in claims 1, 10 and 29. In contrast, Bachrach merely teaches muting **the first arriving signals**, which is not the same as muting **the normal moveout corrected seismic data**. By muting the first arriving signals, Bachrach mutes just a portion of the seismic data. Applicants' claimed invention, however, is directed at muting the normal moveout corrected seismic data, which includes all of the acceleration wavefields, not just the first arriving wavefields.

Zhang is generally directed towards a method for determining compressional wave and shear wave velocities from seismic data. (See Zhang, Abstract). The relevant portions of Zhang are reproduced below for the Examiner's convenience.

In an even further embodiment, the method further comprises a time and depth conversion for both **velocity field** and seismic data. The time and depth conversion produces more **accurate velocity field** in depth allowing the construction of **velocity model for pre-stack migration** and other processing.

(Zhang, column 2, lines 54-58, Emphasis Added).

FIG. 12 shows real seismic data of P—P and P-S time-migrated sections before an example embodiment of **velocity inversion**. The two time-migrated sections are clearly mismatched in time. FIG. 13 shows the P—P

and P-S depth sections after one example embodiment of joint inversion. Both P—P and P-S sections are matched in depth domain **after joint velocity inversion**. It has proven that the **joint velocity inversion** has successfully reconciled the depth between P—P and P-S. The depth-consistent P- and S-wave sections produce enhanced seismic traces for the upgraded delineation of subsurface structures. The converted P- and S-wave images in depth domain is better for identification of the geological framework and risk reduction in reservoir management. The invention is suited for multicomponent seismic data preprocessing and interpretation.

FIG. 14 shows the RMS velocity fields of P—P and P-S in time domain before one embodiment of joint inversion. There is no direct tie between two **velocity** sections in time. FIG. 15 shows the P- and S-wave interval **velocities sections** in depth after joint inversion. They are clearly depth consistent and are used for **prestack** depth imaging and extraction of lithologic information.

(Zhang, column 7, lines 11-32, Emphasis Added).

In an even further embodiment, the method that significantly reduces the turn around time to deliver depth consistent migrated seismic data comprises, providing the P—P depth data mapped from time-migrated data, providing the P-S depth data mapped from time-migrated data, providing the P-wave **velocity** depth model, and providing the S-wave **velocity** depth model.

(Zhang, column 10, lines 60-64, Emphasis Added).

As shown above, Zhang does not teach applying a time migration to acceleration wavefield traces. In contrast, Zhang merely teaches applying a time migration to **velocity fields**, which is not the same as acceleration wavefield traces.

Further, Zhang never mentions applying a time migration to **stacked** acceleration wavefield traces. In contrast, Zhang teaches applying a time conversion for **pre-stack** migration. (See Zhang, column 2, lines 54-58). In this manner, Zhang applies a time migration **before** stacking the acceleration, as opposed to applying the time migration **after** stacking the acceleration wavefields, as recited in claims 1, 10 and 29.

Additionally, although Zhang teaches using accelerometers to acquire seismic data, all of Zhang's seismic data processing steps involve processing the **velocity wavefields**, rather than **acceleration wavefields**. Applicants' claimed invention, on the other hand, is directed at processing seismic data representative of the acceleration wavefield (as opposed to velocity wavefields) to compensate for a low-pass filter effect of the earth due to a lower sensitivity at high frequencies when acquiring velocity data.

(See specification, paragraphs [0016]). Since Zhang teaches applying a time migration to **velocity fields**, the seismic data received by Zhang's accelerometer are transformed to velocity fields such that it may be processed according to method recited by Zhang.

The amendments to claims 1, 10, 22-27 and 29 have been made to more clearly recite the order in which the methods described therein are performed. Support for these amendments may be found throughout the specification, including paragraphs [0082]-[0090]. By performing the processing steps in the order specified by claims 1, 10, 22-27 and 29, Applicants' claimed invention is capable of using acceleration wavefield data to obtain higher quality information about the earth's subsurface without having to transform the acceleration wavefield data to velocity wavefield data. (See specification, paragraph [0012]). Applicants' claimed invention is then capable of compensating for the low-pass filter effect of the earth and the degradation effect to seismic data when transforming the seismic data from acceleration data to velocity data. Neither Bachrach, Varsamis nor Zhang is directed towards processing acceleration data in the manner and order recited in claims 1, 10 or 29 in order to achieve the above objectives.

For these reasons claims 1, 10 and 29 are patentable over Bachrach, Varsamis and Zhang. Claims 13-16 and 21-28 are also patentable over Bachrach in view of Varsamis and Zhang, since they depend from claims 1 and 10. Withdrawal of the rejection is respectfully requested.

Claim 14 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Bachrach in view of Varsamis and Zhang, and further in view of US Patent No. 6,382,332 ("Eaton"). Claim 15 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Bachrach in view of Varsamis and Zhang, and further in view of US Patent No. 6,151,556 ("Allen"). Claim 16 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Bachrach in view of Varsamis and Zhang, and further in view of US Patent Application Publication No. 2004/0109389 ("Quinn"). Neither Bachrach nor Varsamis nor Zhang nor Eaton nor Allen nor Quinn, alone or in combination, teaches "apply a normal moveout correction to the gain recovered acceleration wavefield traces; mute the normal moveout corrected acceleration wavefield traces; stack the muted acceleration wavefield traces; and apply a time migration to the stacked

acceleration wavefield traces," as recited in claim 10. Since claims 14-16 depend from claim 10 and since neither Bachrach nor Varsamis nor Zhang nor Eaton nor Allen nor Quinn, alone or in combination, teaches, discloses or suggests all the limitations of claim 10, claims 14-16 are therefore also patentable over Bachrach, Varsamis, Zhang, Eaton, Allen and Quinn. Withdrawal of the rejection is respectfully requested.

Claims 21, 24 and 28 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Bachrach, Varsamis, Zhang and further in view of U.S. Patent No. 4,520,467 ("Berni"). Claims 22, 23 and 26 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Bachrach, Varsamis, Zhang and further in view of U.S. Patent No. 6,430,510 ("Thomas"). Claim 25 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Bachrach, Varsamis, Zhang and further in view of US Patent No. 5,642,327 ("Schiflett"). Claim 27 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Bachrach, Varsamis, Zhang, Thomas and further in view of US Patent Application Publication No. 2004/0070529 ("Kamas"). Neither Bachrach nor Varsamis nor Zhang nor Berni nor Thomas nor Schiflett nor Kamas, alone or in combination, teaches or discloses "applying a normal moveout correction to the gain recovered acceleration wavefield traces; muting the normal moveout corrected acceleration wavefield traces; stacking the muted acceleration wavefield traces; and applying, using a processor, a time migration to the stacked acceleration wavefield traces," as recited in claim 1. Since claims 21-28 depend from claim 1 and since neither Bachrach nor Varsamis nor Zhang nor Berni nor Thomas nor Schiflett nor Kamas, alone or in combination, teaches, discloses or suggests all the limitations of claim 1, claims 21-28 are therefore also patentable over Bachrach, Varsamis, Zhang, Berni, Thomas, Schiflett and Kamas. Withdrawal of the rejection is respectfully requested.

In conclusion, the references cited by the Examiner, neither alone nor in combination, teach, show, or suggest the claimed invention. Having addressed all issues set out in the office action, Applicants respectfully submit that the claims are in condition for allowance and respectfully request that the claims be allowed.

Respectfully submitted,

/Ari Pramudji/ March 29, 2010

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